

MHI
Copy 3

FM 4-130

WAR DEPARTMENT

**COAST ARTILLERY
FIELD MANUAL**



**ANTIAIRCRAFT ARTILLERY
SERVICE OF THE PIECE
105-MM ANTIAIRCRAFT GUN**

FM 4-130

**COAST ARTILLERY
FIELD MANUAL**



**ANTIAIRCRAFT ARTILLERY
SERVICE OF THE PIECE
105-MM ANTIAIRCRAFT GUN**

**Prepared under direction of the
Chief of Coast Artillery**



**UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON: 1940**

WAR DEPARTMENT,
WASHINGTON, *June 17, 1940.*

FM 4-130, Coast Artillery Field Manual, Antiaircraft Artillery, Service of the Piece, 105-mm Antiaircraft Gun, is published for the information and guidance of all concerned.

[A. G. 062.11 (4-27-40).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

E. S. ADAMS,
Major General,
The Adjutant General.

TABLE OF CONTENTS

	Paragraph	Page
CHAPTER 1. GENERAL.		
Scope	1	1
References	2	1
CHAPTER 2. ORGANIZATION.		
Gun section	3	2
Gun squad	4	2
Ammunition squad	5	3
Formation	6	3
CHAPTER 3. DUTIES OF PERSONNEL.		
Battery executive	7	4
Assistant battery executive	8	4
Gun commander	9	5
Chief of ammunition	10	7
Artillery mechanic	11	8
CHAPTER 4. NOTES ON THE SERVICE OF THE PIECE.		
General	12	10
Signals	13	10
Operation of breech mechanism	14	10
Operation of pneumatic rammer	15	11
Method of handling ammunition	16	13
Service of drill ammunition	17	14
CHAPTER 5. SAFETY PRECAUTIONS.		
General	18	16
Ammunition	19	16
Misfires	20	16
Unloading live rounds	21	16
CHAPTER 6. MAINTENANCE OF MATÉRIEL.		
Section I. General:		
Cleaning and lubrication	22	17
Additional general instructions	23	17
Daily inspection	24	18
II. Maintenance of particular parts and assemblies:		
Gun	25	18
Breech mechanism	26	19
Firing mechanism	27	19
Recoil mechanism	28	19
Gun slides	29	20
Traversing rollers and roller paths	30	20
Elevating rack	31	20
Fuze setter, M9	32	20
III. Malfunctions:		
Malfunctions of gun	33	23
Malfunctions of mount	34	24

TABLE OF CONTENTS

CHAPTER 7. ASSEMBLY AND DISASSEMBLY OF BREECH-		
BLOCK AND FIRING MECHANISM.	Paragraph	Page
Disassembly of firing lock, T7, from breechblock -----	35	25
Disassembly of breechblock from gun -----	36	25
Disassembly of firing lock, T7-----	37	28
Assembly of firing lock, T7-----	38	28
Assembly of breechblock in gun-----	39	29
CHAPTER 8. SERVICE OF RECOIL AND RAMMER MECH-		
ANISMS.		
Section I. Recoil mechanism:		
Filling recoil cylinder-----	40	30
Draining recoil cylinder-----	41	30
Section II. Rammer mechanism:		
Replenishing oil seal in floating piston -----	42	30
Replenishing air pressure to in- itial pressure-----	43	32
Filling front buffer cylinder----	44	32
Draining front buffer cylinder----	45	32
Filling rear buffer cylinder-----	46	33
CHAPTER 9. LUBRICATION.		
General -----	47	34
Lubrication chart-----	48	34
CHAPTER 10. DRILL TABLE-----		38
APPENDIX. LIST OF REFERENCES-----		39

COAST ARTILLERY FIELD MANUAL
ANTIAIRCRAFT ARTILLERY
SERVICE OF THE PIECE
105-MM ANTIAIRCRAFT GUN

CHAPTER I

GENERAL

■ 1. SCOPE.—*a.* This manual prescribes the service of the piece for the 105-mm antiaircraft gun, M3, on 105-mm anti-aircraft gun mount, M1.

b. The matter contained herein is intended only as a guide in the assignment of individuals and duties. Minor changes may be made in order to meet local conditions.

■ 2 REFERENCES.—The references listed in the Appendix should be consulted, especially those pertaining to ammunition and to the care and maintenance of matériel.

CHAPTER 2

ORGANIZATION

■ 3. GUN SECTION.—Each gun emplacement is manned by a gun section consisting of a gun squad and an ammunition squad. The gun commander, a member of the gun squad, is the chief of section. In addition, one artillery mechanic is assigned to each gun section.

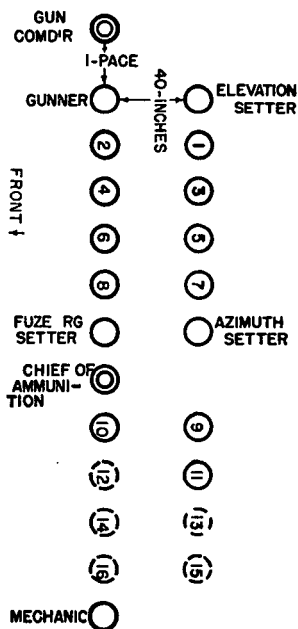


FIGURE 1.—Formation of gun section.

NOTE.—Cannoneers Nos. 12 to 16, inclusive, are included in the war strength organization only.

■ 4. GUN SQUAD.—The gun squad (13 enlisted men) is the same under the peace strength organization as under the war strength organization, and consists of the gun commander (a sergeant), the fuze range setter (a corporal), the gunner (a corporal), the azimuth setter, the elevation setter,

and eight cannoneers numbered from 1 to 8, inclusive. Men are assigned to permanent positions according to their aptitude, but will be interchanged frequently in drill positions to develop flexibility and facilitate replacement.

■ 5. **AMMUNITION SQUAD.**—*a.* Under the war strength organization the ammunition squad (9 enlisted men) consists of the chief of ammunition (a corporal) and eight cannoneers numbered from 9 to 16, inclusive.

b. Under the peace strength organization the ammunition squad (4 enlisted men) consists of the chief of ammunition and three cannoneers numbered from 9 to 11, inclusive.

■ 6. **FORMATION** (fig. 1).—The battery is formed as prescribed in FM 4-120. Each gun section assembles in two ranks with 4 inches between files and 40 inches between ranks. After forming the section, the gun commander takes post in the front rank 1 pace to the right of his section. At the firing point, at the command **FALL IN**, the section normally forms facing the piece.

CHAPTER 3

DUTIES OF PERSONNEL

■ 7. **BATTERY EXECUTIVE.**—*a.* The battery executive commands the firing section (normally 3 gun sections) and is in general charge of all gun emplacements. He is responsible to the battery commander for—

- (1) Training and efficiency of personnel.
- (2) Condition of matériel under his charge.
- (3) Police of emplacements.
- (4) Observance of all safety precautions.

b. He inspects the matériel under his charge and personally verifies the adjustment of all data receivers as frequently as necessary to insure accuracy (and always prior to firing). (See FM 4-110.)

c. He supervises the boresighting and orientation of the guns and the synchronization of the data transmission system. (See FM 4-110.)

d. He receives the reports of the gun commanders and reports to the battery commander, "Sir, gun sections in order," or reports any defects he is unable to remedy without delay.

e. After the emplacements have been reported ready, should circumstances arise which in his opinion would make it unsafe to fire, he commands: **STAND FAST**, and reports his action to the battery commander.

f. At the command **DISMISSED**, given by the battery commander, the executive commands: **REPLACE EQUIPMENT**, inspects the gun positions, and reports to the battery commander.

■ 8. **ASSISTANT BATTERY EXECUTIVE.**—*a.* During the preparation for firing, the assistant battery executive is normally in charge of the service of ammunition for the battery.

b. During firing he is normally assigned to supervise one or more guns, while the battery executive supervises the others.

c. At other times he performs such duties as may be delegated to him by the battery executive.

■ 9. GUN COMMANDER.—*a.* The gun commander (a sergeant) is in charge of the gun section and is also chief of the gun squad. He is responsible to the battery executive for—

- (1) Training and efficiency of the personnel of his section.
- (2) Condition, care, and preparation for action of all matériel, including ammunition, under his charge.
- (3) Observance of all safety precautions pertaining to the service of the piece and the handling of ammunition.
- (4) Police of the emplacement pertaining to his section.
- (5) Care and proper disposal of empty cartridge cases.
- (6) Keeping of a record of the number of rounds fired by his gun during a practice or action and of all other data necessary to keep the gun book accurate and up to date.

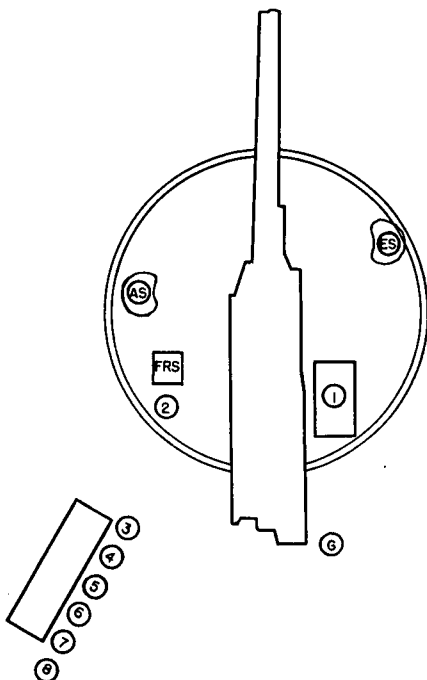


FIGURE 2.—Positions at command DETAILS, POSTS.

b. When the section arrives at the gun emplacement, he commands: 1. DETAILS, 2. POSTS, and supervises the procurement of equipment. After all details have reached their posts (see fig. 2) he commands: EXAMINE GUN. He then personally makes an inspection of the gun, mount, and other matériel, assuring himself that the power is turned on in the data transmission system, that all mechanical pointers are properly adjusted (see FM 4-110), that all electrical pointers are synchronized with their respective transmitters in the director (see FM 4-110), that the pressure in the rammer cylinder is correct, that the oil in the packing seal and in the front and rear rammer buffer cylinders has been replenished, that firing mechanisms and safety devices are in order, that the recoil cylinder and the front and rear buffer cylinders are properly filled, that all moving parts are lubricated, that the breech operating cam has been set for automatic (or hand) operation, that the rammer release tripping cam has been set for proper operation of the rammer, and that the operation of the rammer has been tested by ramming a drill cartridge with the gun at elevations of approximately 800 and 1,100 mils. He then commands: REPORT, receives the reports of the members of the gun section as called for by the drill table (ch. 10), and reports to the battery executive, "Sir, No. _____ in order," or reports any defects he is unable to remedy without delay.

c. He boresights and orients his gun under the supervision of the battery executive. (See FM 4-110.)

d. He supervises the service of the piece and the service of ammunition and personally directs the work of care and preservation of all matériel. He takes his post at any point from which he may conveniently supervise the work of the section.

e. When necessary to verify the section, he gives the command: CALL OFF. The cannoneers of the section call off their titles or numbers in succession, beginning with the unnumbered members of the section, followed by the numbered members in order.

f. At the command TARGET, he repeats the command and target designation and sees that all personnel take post on the run if not already at their posts. He makes sure that

data are being received from the range section, verifies the matching of the pointers on the coarse dials of the azimuth and of the elevation indicators, and if possible verifies roughly the pointing of the gun by sighting along the gun barrel. When the gun is ready for firing he reports or signals to the battery executive, "Sir, No. ——— ready."

g. At the command **COMMENCE FIRING**, he commands: **LOAD**, for the first round only, succeeding rounds being fired without further command, and supervises the work of the section. If a limited number of rounds has been prescribed, he cautions the gunner and the loading detail, "——— (so many) rounds," and commands or signals: **SUSPEND FIRING**, when that number of rounds has been fired. He then reports to the battery executive, "Sir, No. ——— (so many) rounds fired."

h. At the command **SUSPEND FIRING**, he repeats the command, sees that the details remain posted, and that the gun continues to follow the target. He directs the clearing away of empty shell cases and the preparation of matériel for further firing.

i. At the command **CEASE FIRING**, he repeats the command and proceeds as at **SUSPEND FIRING**, except that the following of the target is discontinued.

j. At the command **REST**, he repeats the command and allows the members of the section to leave their posts but requires them to remain in the immediate vicinity of the gun.

k. At the command **REPLACE EQUIPMENT**, he repeats the command, supervises the replacement of equipment, sees that the emplacement is policed, and forms his section.

l. In case of misfire he commands: **STAND FAST**, and sees that the precautions prescribed in paragraph 20 are observed.

■ **10. CHIEF OF AMMUNITION.**—*a.* The chief of ammunition (a corporal) is in charge of the ammunition squad. He is responsible to the gun commander for—

(1) Training and efficiency of the personnel under his charge.

(2) Condition and serviceability of the ammunition pertaining to the gun.

(3) Observance of all safety precautions in the care and service of the ammunition.

(4) Correct recording of required ammunition data.

(5) Cleaning and disposition of empty cartridge cases.

(6) Uninterrupted service of ammunition to the gun emplacement during the course of a practice or action.

b. He supervises the ammunition squad in the placing of the ammunition racks, the preparation of ammunition for service, and in such duties in connection with the preparation of the emplacement as may be directed by the gun commander.

c. At the command **DETAILS, POSTS**, he posts the members of the ammunition squad and assigns them duties to facilitate ammunition handling.

d. At the command **EXAMINE GUN**, he inspects the ammunition under his charge for possible defects (especially the fuzes for looseness, corrosion, and injury), gives the necessary instructions for preparing and arranging the ammunition for possible firing, and reports to the gun commander, "Ammunition service in order," or reports defects he is unable to remedy without delay.

e. During firing he supervises the ammunition squad in replenishing the ammunition racks, disposing of empty cases, and handling and storing of any additional supply received. He should be prepared at all times to furnish from the ammunition squad replacements for the gun squad when members of that squad become casualties.

f. At the command **REPLACE EQUIPMENT**, he supervises the ammunition squad in the securing and covering of all ammunition pertaining to the gun, makes certain that all fuzes that have been cut but not fired have been set back to the setting of 15, helps in the police of the emplacement, and forms his squad unless otherwise directed.

■ **11. ARTILLERY MECHANIC.**—The artillery mechanic, assisted by other members of the gun section, makes such minor repairs as can be made with the means at hand. He is responsible for the proper lubrication of the gun and mount and maintains a lubrication record showing the dates on which the various parts of the gun and mount were lubri-

cated. He is custodian of the supplies pertaining to the emplacement. He is responsible to the chief of section for the condition and serviceability of the supplies and tools under his charge. He maintains an up-to-date inventory of all tools, equipment, spare parts, and supplies under his charge. He issues such equipment, tools, oils, paints, and cleaning materials to the members of the gun section as may be necessary for the service and care of the guns and accessories.

CHAPTER 4

NOTES ON THE SERVICE OF THE PIECE

■ 12. GENERAL.—*a.* The service of the piece should be conducted with dispatch and precision and with as few orders as possible. Cannoneers change positions at a run. Commands should be given in the prescribed form, but should be replaced by signals whenever practicable. Except for the necessary orders, reports, and instructions, no talking should be permitted.

b. Loading with drill ammunition as described in paragraph 17 and pointing the piece as for firing are normal practices at drill.

c. The commands or signals ELEVATE, DEPRESS, RIGHT, or LEFT refer to the direction of motion of the muzzle of the gun.

■ 13. SIGNALS.—The following whistle signals are authorized:

a. DETAILS, POSTS—a series of short blasts.

b. COMMENCE FIRING—one long blast.

c. SUSPEND FIRING—one or more long blasts until the firing has been stopped.

■ 14. OPERATION OF BREECH MECHANISM.—*a.* For *hand* operation, No. 3 pulls the cam cover latch plunger outward and turns the operating cam cover to the rear and downward, thereby placing the operating cam in such position that it does not touch the lug on the operating lever during recoil or counterrecoil. No. 1 grasps the handle grip and rotates the operating handle to the rear and downward until the extractors lock the breechblock open, *and then returns the handle to the locked vertical position.* The breech is closed when the rim of the base of the cartridge case trips the extractors, thus freeing the breechblock from the extractor trunnions, and allowing the closing spring to rotate the operating shaft and carry the breechblock up and into the closed position.

b. For *automatic* operation of the block, No. 3 places the operating cam in position by reversing the details given in *a* above. The breech is first opened as indicated for hand operation and the handle raised. Thereafter the breech will open automatically during counterrecoil, ejecting the empty case.

c. The firing mechanism is of the self-cocking continuous pull type; on release of the lanyard, the firing pin automatically returns to the cocked position.

■ 15. OPERATION OF PNEUMATIC RAMMER.—*a.* The pneumatic rammer is operated by the action of compressed air between a cylinder in the rammer piston (attached to the rammer body) and a hollow plunger (assembled to the stationary cradle extension). In ramming a cartridge, the breechblock in closing strikes the rammer head and pushes it into the upper latched position. Having rammed a cartridge into the gun, the rammer is automatically retracted by the action of the “kicker” during the recoil of the gun. For high angle fire when it is desired to stop the ejected cartridge case in the loading tray, the rammer tripping cam is engaged by lifting the knob of the plunger from the shallow notch, turned 90° into the deep notch, and pulled back until the plunger engages the hole in the cam. When the rammer tripping cam is in this position, it acts to trip the rammer release lever and permit the rammer spring to push the rammer down into the loading position. In this position, the rammer stops the ejected cartridge case in the loading tray; the empty case is removed from the tray by No. 9, who is equipped with asbestos gloves for that purpose. For medium and low angle fire, however, the rammer tripping cam is placed in the disengaged position and the ejected cartridge case is thrown clear of the mount.

b. Before firing, the *air pressure* is checked by the gun commander. The reading, with rammer forward and the gun cool (not recently fired), should be approximately 80 pounds per square inch. If the gun is well warmed up through firing, the pressure will normally increase due to temperature rise as the rammer is exercised. Failure of the rammer to latch back indicates that the pressure has increased beyond the operating limits, in which case it should

be reduced to approximately 90 pounds. The proper pressure should be obtained, if the gun is cool, by replenishing or relieving the pressure. Replenishment of pressure is made by the gunner and No. 1 with the hand air pump. To relieve the pressure (see fig. 7), remove the cap from the pump connection valve (4); then screw handwheel (5) in until the air valve is unseated; push down the inside valve by means of the cap and allow air to escape. The rammer should be tested by ramming a drill cartridge with the gun at elevations of approximately 800 and 1,100 mils. If it does not work satisfactorily when the prescribed pressure is registered on the gage, the ordnance officer should be notified. Before firing commences, the gage cock should be closed; otherwise, the high pressure built up when the rammer is retracted will damage the gage.

c. The sequence of events in the operation of the rammer is as follows:

(1) When it is desired to eject the empty cartridge case clear of the mount, No. 1 opens the breech by pulling the operating handle to the rear. He returns the handle to the vertical position and pushes the rammer into the upper latched position by hand. He places the knob of the rammer tripping cam in the shallow notch. This disengages the tripping cam and permits the rammer to remain in the upper position at the end of the retracting stroke, thereby permitting the ejected cartridge case to slide under the rammer and clear of the mount. No. 3 sets the operating cam in position to engage the operating shaft and thereby drop the breechblock during counterrecoil. The gunner lifts the rammer retracting lever while No. 1 retracts the rammer by hand, by means of the rammer retracting handwheel, until the rammer latches back into the sixth notch. For this retraction, the elevation setter lays the piece at a convenient angle of elevation, as directed by the gunner. The gunner lowers the rammer to the loading position by a pull on the rammer release lever. No. 3 (4, 5, 6, 7, or 8) places a cartridge (on which the fuze has been set) in the loading tray in front of and as close to the rammer head as his right hand will permit, slides the cartridge backward into contact with

the rammer head, steps away quickly to avoid injury to arms or hands from the released rammer, and commands: **RAM.**

NOTE.—If the rammer head has been modified by the installation of an adequate buffer to absorb the impact, the cartridge need not be adjusted to contact with the rammer head.

The gunner pulls the rammer latch release lever, permitting the rammer to push the cartridge into the gun. After the breechblock has closed, the gunner fires the gun by a pull on the lanyard. After firing and during counterrecoil, the breechblock is dropped automatically; the empty cartridge case is ejected, slides under the rammer, and is thrown clear of the mount. The gunner drops the rammer, and the operations of loading proceed as before.

(2) When it is desired to have the ejected cartridge case stopped in the loading tray, the operations are the same as given in (1) above except that No. 1 places the knob of the rammer tripping cam in the deep notch and pulls back the knob until the plunger seats in its hole provided in the cam. This engages the rammer tripping cam in a position such that it causes the rammer to drop at the end of the retracting stroke, and thereby stops the ejected cartridge case in the loading tray. Thus it is not necessary for the gunner to drop the rammer for the next round.

d. In the event of injury to the rammer, it may be left in the retracted position, and each round rammed by hand, using the special rammer provided. A cannoneer from the ammunition squad should be assigned this duty.

■ **16. METHOD OF HANDLING AMMUNITION.**—*a.* Ammunition is served from the ammunition rack to the fuze setter and from the fuze setter to the gun by the loading detail. Nos. 3, 4, 5, 6, 7, and 8 form in column at the ammunition rack facing the breech of the gun. At the command **TARGET**, No. 3 takes a round, right hand grasping the base of the cartridge case with the rotating band of the projectile resting in the crook of his left arm, and proceeds by the most direct route to the fuze setter. The round is deposited in the fuze setter in the manner described in the drill table (ch. 10). Nos. 4, 5, 6, 7, and 8 each grasp a round as prescribed for No. 3 and proceed to the left of the fuze setter, where they stand in readiness to deposit their rounds, in turn, in the setter.

b. At the command **LOAD**, No. 2 sets the fuze and calls "Cut." No. 3 removes the round from the fuze setter, grasping it as described above, and places it in the loading tray near the rammer head. He then returns to the ammunition rack, obtains another round, and falls in behind No. 8 on the left of the fuze setter. Nos. 4, 5, 6, 7, and 8, in turn, perform the operations just described for No. 3 until the command **SUSPEND FIRING** or **CEASE FIRING** is received.

c. (1) At the command **SUSPEND FIRING**, if an unfired round is in the gun, it is ejected onto the loading tray under the direction of the gunner. This round is then removed from the loading tray and laid aside by that member of the loading detail who placed it therein. If there is no round in the fuze setter, the next succeeding member of the loading detail inserts one, and the remaining members of the loading detail stand ready to continue the service of ammunition when firing is resumed.

(2) At the command **CEASE FIRING**, the procedure described in (1) above is followed, and, in addition, if there is a round in the fuze setter or in the gun, the fuze range setter sets his fuze range pointer to 15; No. 2 then sets the fuzes on those rounds, and on any other rounds necessary, to 15.

■ 17. **SERVICE OF DRILL AMMUNITION.**—*a.* When using drill ammunition, the loading cycle is as prescribed in paragraph 16 *a* and *b*, except that each member of the loading detail (Nos. 3, 4, 5, 6, 7, and 8) removes his round from the loading tray (without its having been rammed into the gun) immediately after placing it therein. The rammer head remains latched in the upper position, and the rounds are slid out the rear of the loading tray. Rounds thus removed are returned to the ammunition rack where they are used again by the loading detail.

b. Just prior to the loading of one of the last four rounds of each drill series or group ordered, the gun commander signals the gunner to ram the next round. Immediately after the next round is placed in the loading tray, the gunner drops the rammer head, rams the round into the gun, and pulls the lanyard. No. 1 retracts the rammer so that the head will drop directly behind the breech, drops the rammer head, opens

the breech, and eases the round back into the loading tray by retracting the rammer until it is latched back in the loading position. The round is removed and replaced on the ammunition rack by the member of the loading detail who loaded it. The gunner raises the rammer head to its upper latched position, and the remainder (if any) of the rounds ordered are loaded as prescribed in *a* above. During different drill courses, the gun commander should signal the gunner to drop the rammer head while different men are placing their rounds in the loading tray; the members of the loading detail should not know which round is to be rammed and fired.

CHAPTER 5

SAFETY PRECAUTIONS

■ 18. GENERAL.—The safety precautions described herein are prescribed for peacetime, but under war conditions should be interpreted by the proper officers according to the circumstances.

■ 19. AMMUNITION.—*a.* All ammunition at the firing point must be so placed that it will be protected against explosion in case of an accident at the gun position. It should be in a dry place, and protected from the direct rays of the sun by a tarpaulin or other covering. Erratic shots and possibly dangerously high powder pressures may result from overheated ammunition.

b. Any alteration of loaded ammunition, especially time fuzes, except in accordance with specific instructions from the Chief of Ordnance, is hazardous and is therefore prohibited.

c. When checking the accuracy of fuze setting by cutting trial fuzes, do not cut the fuze on any one projectile more than twice.

■ 20. MISFIRES.—In case of a misfire, at least three attempts to fire the primer will be made. The gun will be kept laid on a safe place in the field of fire, and the breechblock will not be opened until at least 2 minutes after the last attempt to fire the piece.

■ 21. UNLOADING LIVE ROUNDS.—*a.* After unloading unfired rounds, set the fuzes to 15.

b. If a round cannot be extracted in the normal manner, it should be fired, safety precautions permitting. If this is impossible, it should be removed under the direct supervision of an officer, a rammer being used which bears only on the projectile and provides for clearance around the fuze. (See *TM 9-1900.)

*See Appendix.

CHAPTER 6

MAINTENANCE OF MATÉRIEL

	Paragraphs
SECTION I. General	22-24
II. Maintenance of particular parts and as- semblies	25-32
III. Malfunctions	33-34

SECTION I

GENERAL

■ 22. **CLEANING AND LUBRICATION.**—The proper maintenance of matériel is the direct responsibility of battery personnel. The gun and mount should be thoroughly cleaned and lubricated at intervals not exceeding 2 weeks and, when fired, as soon as possible after firing. Care should be taken to keep all parts free from rust and dirt. Particular attention should be given to sliding and bearing surfaces of the breechblock, gun, and cradle, the rammer piston body slide in the right cradle extension, roller and ball bearings, elevating rack, and traversing rack. If the gun and mount are not to be used for short intervals, all bright and bearing surfaces should be covered with a coat of light class D lubricating oil. If they are to be left unused for a considerable length of time, all bright and unpainted surfaces should be cleaned thoroughly with dry-cleaning solvent (*not kerosene*) so as to be free from rust, water, and lubricating oil, and coated with rust-preventive compound; and the rammer should be operated once every 2 weeks.

■ 23. **ADDITIONAL GENERAL INSTRUCTIONS.**—*a.* Disconnecting the gun from the recoil mechanism will not be attempted by the using personnel.

b. Replace and open cotter pins after replacing nuts.

c. Do not strike any metal part directly with a hammer; interpose a buffer of wood or copper.

d. Oil holes which have become clogged with oil should be opened with a piece of wire. Wood should never be used for this purpose, as splinters are likely to break off in the hole.

e. As an aid to ready identification, grease and oil nozzles and oil hole covers are painted red. Oil holes have a red ring painted around them.

f. When any part starts to show wear, steps should be taken to have on hand a replacement part.

■ 24. DAILY INSPECTION.—Daily inspection should be made by the gun crew to discover any parts which need adjustment or attention. This includes the following:

a. Open and close the breech to see that it operates freely.

b. Examine the breech recess and bore to see that they are clean.

c. See that the firing mechanism works freely.

d. Elevate and depress the gun to see that the mechanism operates without binding or undue lost motion.

e. Traverse the gun to the right and left through the full extent of its travel to see that the mechanism operates without binding or undue lost motion.

f. See that the sliding surfaces of the gun and cradle are clean and well-lubricated.

g. See that all working parts are thoroughly lubricated.

h. Examine recoil system for oil leaks.

i. Examine all keys, thongs, and hinges to see that they are in serviceable condition.

j. Check tools and accessories to see that they are in their proper position and that none are missing.

SECTION II

MAINTENANCE OF PARTICULAR PARTS AND ASSEMBLIES

■ 25. GUN.—a. As soon as possible after firing, the bore should be washed with a solution of $\frac{1}{2}$ pound of soda ash or 1 pound of sal soda per gallon of boiling water, a sponge being used for swabbing purposes. Special attention should be given to that portion of the bore extending from the origin to a point about 24 inches forward, as most of the fouling takes place in that area. Cleaning should be followed by thorough drying with the sponge covered with burlap, after which the bore should be oiled with a light coat of rust-preventive compound applied with the bore slush brush.

b. The surfaces of the leveling plates mounted in the breech ring should be protected from injury. Tools or other articles should never be laid upon them. In case of accidental injury, repairs should be made by ordnance personnel.

■ 26. BREECH MECHANISM.—*a.* The breech mechanism should be kept clean and well lubricated at all times with light lubricating oil, class D. It should be disassembled periodically (and always immediately after firing) and cleaned and oiled. In case the mechanism is to be left unused for a considerable length of time, all bright surfaces should be coated with rust-preventive compound.

b. Vigilance must be maintained to detect any abrasions forming on the pressure side of the wearing surfaces in the various ribs and grooves of the breechblock and the breech recess and on the trunnions of the extractors. Such abrasions must be removed at once by ordnance personnel.

c. The breech should be kept covered to prevent dust and grit from getting into the mechanism.

■ 27. FIRING MECHANISM.—*a.* The firing mechanism should be disassembled frequently (and always after each firing period). All burrs and rough surfaces should be removed with a smooth file. The parts should be washed in dry-cleaning solvent and wiped dry. When reassembling, the parts should be lightly coated with light class D lubricating oil (Fed. Spec. VV-O-496).

b. The use of oil thicker than authorized will cause the mechanism to absorb the energy of the firing spring and will result in misfires. This is especially true in cold weather when unsuitable oil congeals and becomes gummy.

c. Examination should be made for wear on the front and rear faces of the trigger fork, and also at the edge of the opening in the firing pin holder where the trigger fork passes through.

■ 28. RECOIL MECHANISM.—*a.* Under no circumstances should an attempt be made to take the recoil mechanism apart.

b. The proper kind and amount of oil (heavy recoil oil, low pour point, U. S. A. Spec. 2-96) should be maintained at all times in the recoil mechanism.

c. Every precaution should be taken to prevent the entrance of foreign matter into the recoil mechanism.

d. The oil used in filling the recoil mechanism should be strained through a fine clean cloth, and the receptacles used in handling the oil should be clean.

e. The gun commander should constantly verify the complete return of the gun into battery. If the gun does not return to battery, or does so irregularly by jerks or jumps, he should command: **CEASE FIRING**, and look for the cause of trouble.

f. If the mount is to remain unused for long periods, the gun should be elevated to its maximum elevation and the recoil cylinder filled to capacity to prevent the walls from becoming dry and rusty.

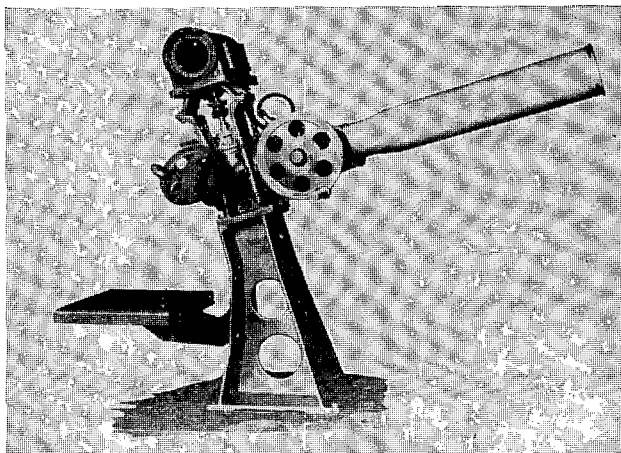
■ 29. **GUN SLIDES.**—The gun slides will be thoroughly cleaned frequently and covered with a film of grease, medium.

■ 30. **TRAVERSING ROLLERS AND ROLLER PATHS.**—The cover plate outside the working platform and the dust guards should be removed and the traversing rollers and roller paths should be thoroughly cleaned at least once a year. The rollers and paths are wiped with a cloth dampened with dry-cleaning solvent. All rust spots are removed with crocus cloth. A coating of light class D lubricating oil is spread on the rollers and paths. The bearings of the rollers are lubricated by pouring light class D lubricating oil into the oil pipes. The mount is then traversed slowly through 360°, and examination is made to see that oil is flowing in the oil groove of the distance ring.

■ 31. **ELEVATING RACK.**—The teeth of the elevating rack should be cleaned and coated with graphite grease. Raised or rough surfaces should be removed with a smooth file.

■ 32. **FUZE SETTER, M9 (fig. 3).**—*a. Cleaning and lubrication.*—Before operation, the fuze setter should be opened and all parts accessible should be cleaned with clean, lint-free cloths. It should then be well lubricated. Lubricating facilities are painted red for identification. Light lubricating oil, class A, should be used in the oil holes provided and for all moving surfaces in contact, including hooks, levers, latches, and plungers. Interior parts not accessible should be flushed out with the lubricating oil through the numerous vents provided.

The ball bearings in the hub of the indicator bracket are packed with a mixture of 60 percent petrolatum (U. S. A. Spec. 2-67) and 40 percent rust-preventive compound, grade "B" medium (U. S. A. Spec. 2-78A). They are packed during initial assembly and should not require further attention for several years. Repacking should be done by ordnance personnel.



① Closed.

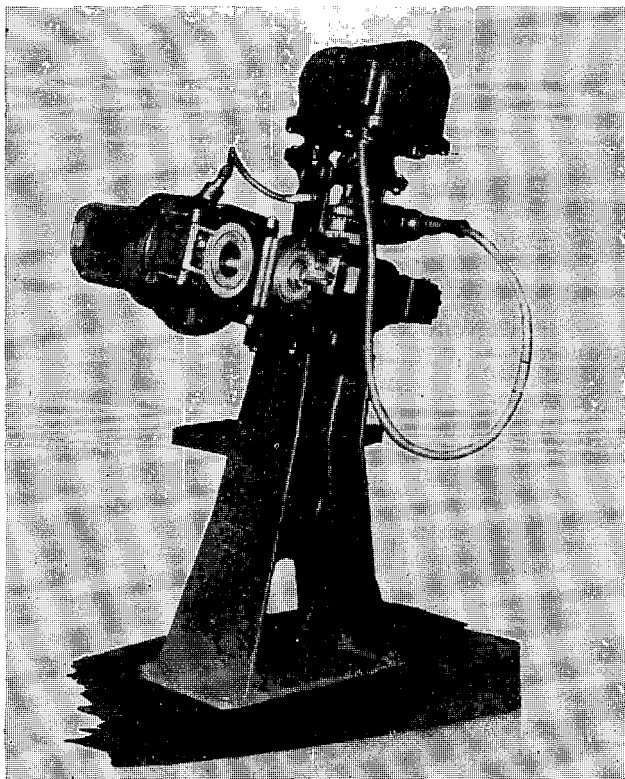
FIGURE 3.—Fuze setter, M9.

b. Malfunctionings which cannot be remedied by members of the gun section should be reported at once to the ordnance officer. Malfunctionings which may be encountered during operation include—

- (1) Failure of the round to release after a fuze is set.
- (2) Rebound of the setting handwheel from its stop position at the end of the four-turn cycle.
- (3) Failure of the setting handwheel to stop at the end of four turns.
- (4) Development of excessive backlash. The backlash should not exceed $\frac{1}{10}$ second. To check the backlash, a particular value should be set on the indicator by turning the adjusting handwheel clockwise. The fuze should then be set, the round removed from the setter, and the setting on the

fuze read. The indicator should then be turned past the original setting by turning the handwheel in the same direction as before (clockwise), then returned to the original setting by turning the handwheel in the opposite direction (counterclockwise). The fuze should then be set again and the setting read. The difference between the two readings of the fuze is an indication of the amount of backlash.

c. *Adjustment* of mechanical and electrical pointers is described in TM 4-210 and FM 4-110.



② Open.

FIGURE 3.—Fuze setter, M9—Continued.

SECTION III

MALFUNCTIONS

■ 33. MALFUNCTIONS OF GUN.—The following chart indicates malfunctions which may be encountered, with causes and action to be taken:

Malfunction	Cause	Correction
a. Fails to fire; no percussion on primer obtained. b. Fails to fire until after several percussions on primer.	a. Weak or broken firing spring, broken trigger fork, broken firing pin holder, broken firing pin. b. (1) Firing pin holder and firing spring not working freely. (2) Deformed firing pin.	a. Remove firing lock, T7, from breechblock. Disassemble mechanism and replace broken parts. b. (1) Remove firing lock, T7, from breechblock, disassemble mechanism, and remove all burrs and rough spots from parts with a smooth file or oil stone. Wash parts with dry-cleaning solvent and dry thoroughly. When reassembling, lubricate each part with light class D lubricating oil. (2) Remove firing lock, T7, from breechblock. Remove cotter pin holding firing pin in firing pin holder, remove firing pin, and replace with new firing pin.
c. Fails to fire when proper percussion is obtained.	c. Defective primer.	c. After three percussions, wait 2 minutes before opening breech to insert another round of ammunition.
d. Breechblock fails to rise when extractors are forced forward.	d. (1) Weak or broken closing spring; broken cable chain. (2) Lack of lubrication. (3) Burs or roughened surface on sides of breechblock and breech recess.	d. (1) Remove spring cylinder cap as outlined in paragraph 36 and replace broken parts. (2) Lower breechblock and clean breech recess and breechblock with a cloth dampened in dry-cleaning solvent. Lubricate breech recess and bearing surface of breechblock with light class D lubricating oil. (3) Notify ordnance officer.

■ 34. MALFUNCTIONS OF MOUNT.—The following chart indicates malfunctions which may be encountered, with causes and action to be taken:

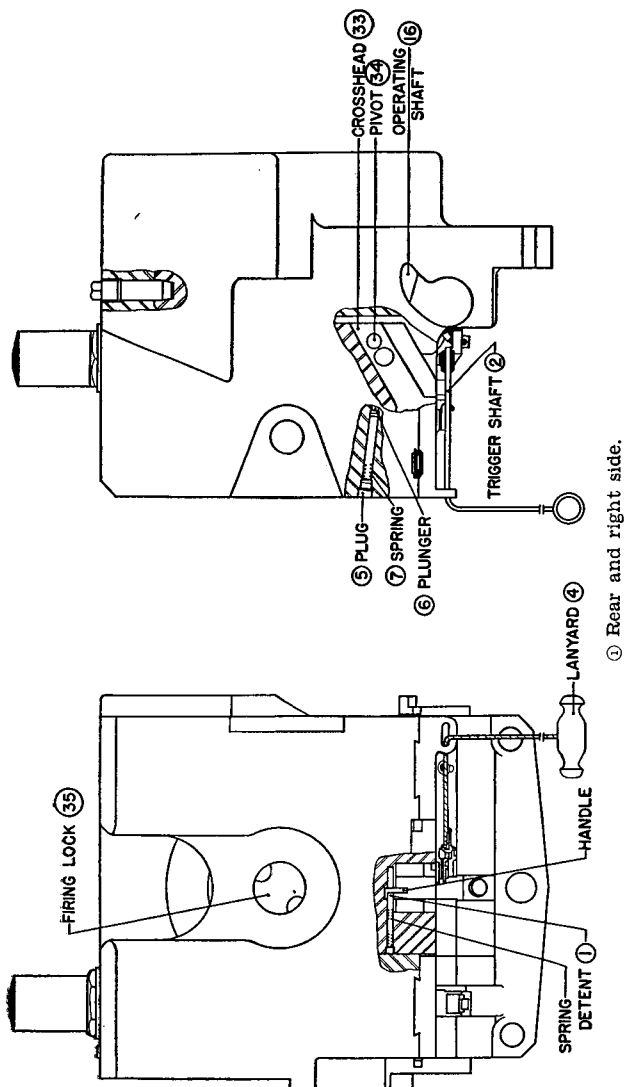
Malfunction	Cause	Correction
<i>a.</i> Gun will not return fully into battery.	<i>a.</i> (1) Too much oil in recoil cylinder. (2) Counterrecoil spring broken.	<i>a.</i> (1) Elevate to 80°, remove filling plug, and allow oil to drain out. (2) Notify ordnance officer.
<i>b.</i> Gun recoils more than distance allowed.	<i>b.</i> Insufficient oil in recoil cylinder.	<i>b.</i> Fill recoil cylinder to normal.
<i>c.</i> Gun returns to battery with too great a shock.	<i>c.</i> Insufficient oil in recoil cylinder.	<i>c.</i> Fill recoil cylinder to normal.
<i>d.</i> Loading mechanism does not move in recoil.	<i>d.</i> Broken kicker cam roller pin.	<i>d.</i> Notify ordnance officer.
<i>e.</i> Loading mechanism does not move when tripped.	<i>e.</i> (1) Air pressure low. (2) Gage shows correct pressure.	<i>e.</i> (1) Attach air pump and establish correct pressure. (2) Notify ordnance officer.
<i>f.</i> Loading mechanism rebounds when it strikes front buffer.	<i>f.</i> Insufficient oil in front buffer cylinder.	<i>f.</i> Fill cylinder to normal.
<i>g.</i> Rammer body will not latch in upper position.	<i>g.</i> Broken compression spring.	<i>g.</i> Disassemble and replace spring.
<i>h.</i> Rammer body slow in dropping to ramming position.	<i>h.</i> Broken or weak compression spring.	<i>h.</i> Remove rammer body from rammer body guide and replace spring.

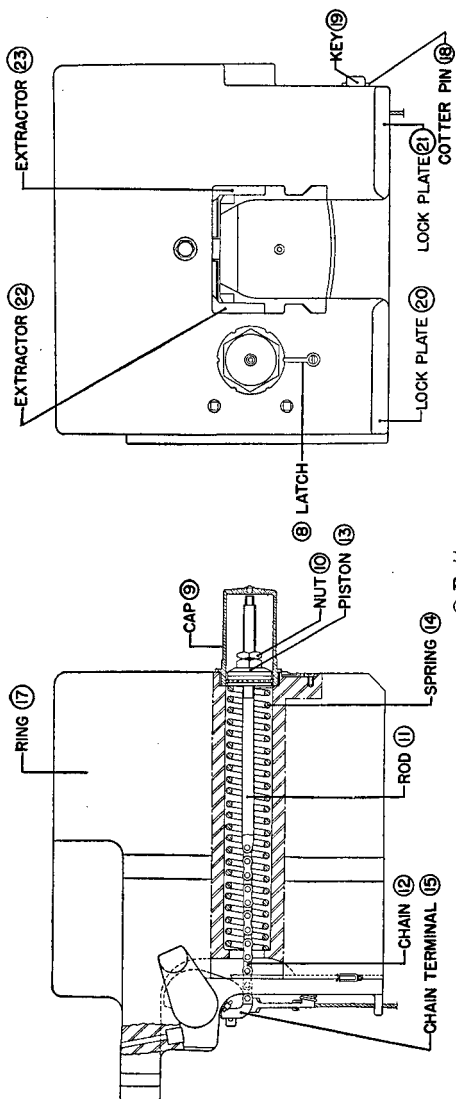
CHAPTER 7

ASSEMBLY AND DISASSEMBLY OF BREECHBLOCK AND FIRING MECHANISM

■ 35. DISASSEMBLY OF FIRING LOCK, T7, FROM BREECHBLOCK (figs. 4 ① and 5).—Open breech, depress trigger shaft detent (1) to the left and pull trigger shaft (2) down and out of breechblock. Close breech. Turn firing case (3) one-sixteenth of a turn in either direction and draw it out of breechblock.

■ 36. DISASSEMBLY OF BREECHBLOCK FROM GUN (fig. 4).—Open breech. Uncouple lanyard (4) from trigger shaft (2) and remove lanyard. Depress trigger shaft detent (1) to the left and pull trigger shaft (2) down and out of breechblock. Unscrew extractor plunger plugs (5) and remove extractor plungers (6) and compression springs (7). Close breech. Screw eyebolt into top of breechblock and attach sling and hoist to support breechblock. Depress spring cylinder cap latch (8) and unscrew spring cylinder cap (9) from closing spring hole. Unscrew spring rod nut (10) from closing spring rod (11). (*Caution:* To start spring rod nut use two wrenches, one on closing spring rod so as not to twist and injure cable chain (12) and the other on nut.) Unscrew spring rod piston (13) to release compression on compression spring (14). Depress compression spring (14) and unlock chain terminal (15) from operating shaft (16). Lift spring rod piston (13), cable chain (12), and chain terminal (15) out of breech ring (17). Remove cotter pin (18) from lock plate key (19) and drive out lock plate key. Remove lock plates (20) and (21) by drawing them to the rear. Lower breechblock to a point where bottom rear face is 2 inches below breech ring. With one hand on each end of operating shaft (16) lift shaft out of its bearings and draw it to rear and down out of breechblock. Lower breechblock, by means of the rope sling, out of the breech recess. Remove extractors (22) and (23) from breech recess.





③ Bottom.

FIGURE 4.—Breech mechanism assembly.

■ 37. **DISASSEMBLY OF FIRING LOCK, T7** (figs. 4 ① and 5).—Remove trigger fork (24) by placing the blade of a screwdriver through the round hole opposite the square hole in firing case (3) and push on one end of trigger fork. Insert trigger shaft (2) far enough into firing case to engage fork end of sear (25). Turn trigger shaft in the direction to disengage sear from firing pin holder (26). Bump firing case lightly against a wood block to start firing pin holder out of firing case. Place screwdriver through square hole and pry against firing pin holder sleeve (27) until it can be drawn out by hand. Remove trigger shaft (2), sear (25), and compression spring (28). To remove firing pin (29), draw out cotter pin (30), and unscrew firing pin from firing pin holder (26).

NOTE.—In assembling operations, all bearing surfaces should be given a coating of light class D lubricating oil.

■ 38. **ASSEMBLY OF FIRING LOCK, T7** (figs. 4 ① and 5).—*a.* Screw firing pin (29) into firing pin holder (26) to the shoulder. Insert cotter pin (30) through firing pin holder and spread ends of cotter pin.

b. Place spring stop (31) on firing pin holder with long guides to rear.

c. Assemble compression spring (32) over firing pin holder. Guide firing pin holder sleeve (27) over compression spring (32) and align firing pin holder sleeve with hook of firing pin holder; place firing pin holder sleeve against a block or bench and press in firing pin holder until hook on firing pin holder engages firing pin holder sleeve.

d. Place compression spring (28) into its seat in firing case (3). Assemble sear (25) in firing case with spring knob of sear engaging compression spring (28). Insert trigger shaft (2) into firing case and sear. Depress sear with a screwdriver through hole in side of firing case opposite compression spring (28) and assemble firing pin holder sleeve assembly (as assembled in *c* above) into firing case with flat side of firing pin holder sleeve toward sear. Push firing pin holder sleeve assembly into firing case, guiding spring stop guides into guide slots in firing case. When firing pin holder (26) reaches bottom of firing case, sear will snap into engaged position and hold assembly in firing case.

e. Remove trigger shaft (2) from firing case (3) and assemble trigger fork (24) with side marked "Muzzle face" toward firing pin (29). Press down on trigger fork until it snaps into place with its square hole in line with trigger shaft hole.

■ 39. ASSEMBLY OF BREECHBLOCK IN GUN (figs. 4① and 5).—*a.* Place the gun in a horizontal position. Provide a hoist over breech recess to raise and control height of breechblock.

b. Screw lifting eye into top of breechblock and attach a rope sling. Pass sling up through breech recess and attach it to hoist.

c. Assemble firing lock, T7, in the breechblock. Place extractors (22) and (23) in position in breech recess.

d. Raise breechblock into breech recess to a point where bottom rear face is 2 inches below breech ring. Retain in this position.

e. Place operating shaft cross heads (33) on cross head pivot (34) assembled to operating shaft (16). Grasp each end of operating shaft and rest it on edge of breech ring operating shaft bearings. Have arm of operating shaft horizontal and pointed to rear. Rotate operating shaft on edge of breech ring operating shaft bearings, and guide operating shaft cross heads (33) into breechblock. When cross heads have entered, roll and push operating shaft into its bearing in breech ring.

f. A small amount of stiff grease placed between the sides of operating shaft arm and cross heads will prevent cross heads from turning while being assembled in breechblock.

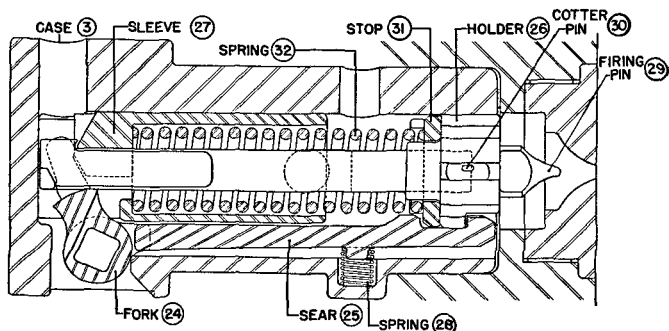


FIGURE 5.—Firing lock, T7.

CHAPTER 8

SERVICE OF RECOIL AND RAMMER MECHANISMS

	Paragraphs
SECTION I. Recoil mechanism.....	40-41
II. Rammer mechanism.....	42-46

SECTION I

RECOIL MECHANISM

■ 40. FILLING RECOIL CYLINDER (fig. 6).—Elevate gun to 80°. Remove filling plug (1) and vent plug (2) and fill recoil cylinder to overflowing, using filling funnel provided. Replace filling plug and vent plug.

■ 41. DRAINING RECOIL CYLINDER (fig. 6).—With gun at 0° elevation, place a receptacle under drain plug (3), and remove drain plug. If recoil oil does not flow freely, remove vent plug (2).

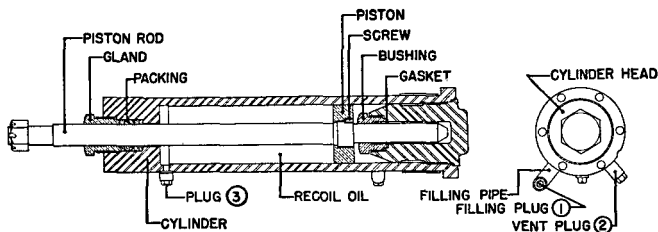


FIGURE 6.—Recoil cylinder.

SECTION II

RAMMER MECHANISM

■ 42. REPLENISHING OIL SEAL IN FLOATING PISTON (fig. 7).—This service is performed before each firing period or when directed by the battery commander. Remove rammer piston valve body cap (1), attach oil screw filler filled with heavy

recoil oil, low pour point (U. S. A. Spec. 2-96) to bayonet type fitting, and turn handle of filler until filler is emptied.

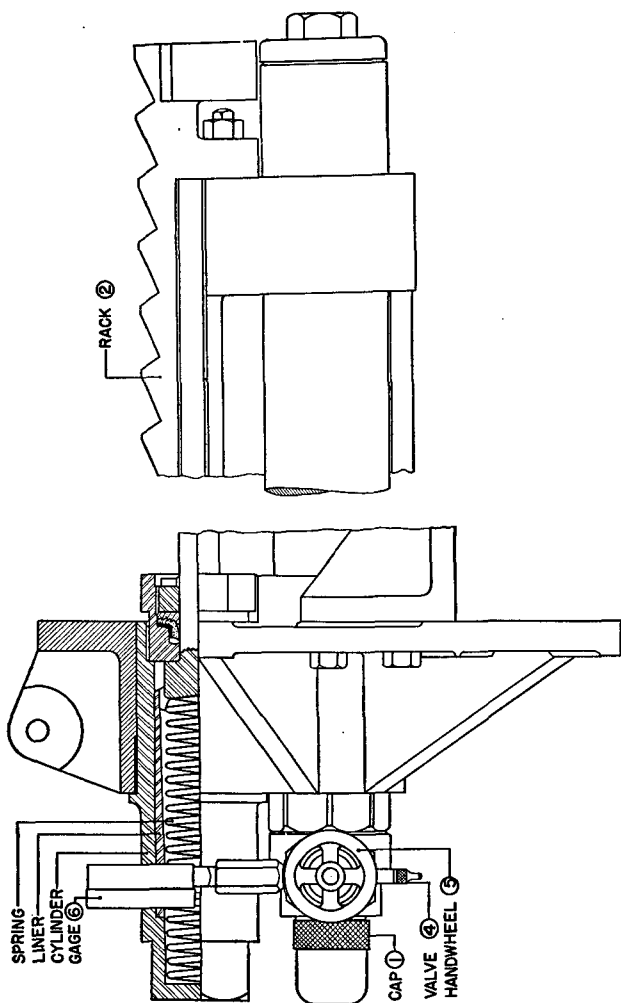


FIGURE 7.—Portion of loading mechanism.

■ 43. REPLENISHING AIR PRESSURE TO INITIAL PRESSURE (figs. 7 and 8).—Have rammer latch rack (2) resting against front buffer piston (3). Attach hose of air pump provided to valve (4), being careful not to strip threads of valve. Open rammer piston air valve by turning air valve handwheel (5). Pump air into valve by means of air pump, which should be attached to breech operating platform on right side of mount for that purpose. When pressure gage (6) indicates a reading of 80 pounds per square inch, close rammer piston air valve, detach air pump hose, and remove air pump from breech operating platform. Care should be taken not to elevate or depress gun while air hose is connected.

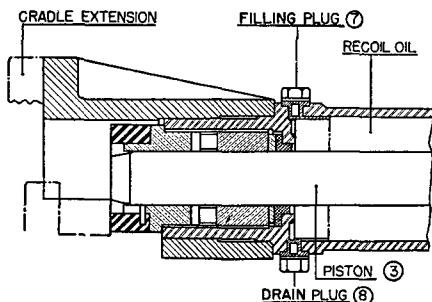


FIGURE 8.—Rear portion, front buffer (sectioned view).

■ 44. FILLING FRONT BUFFER CYLINDER (fig. 8).—Depress gun as far as it will go. Remove filling plug (7) located at top of front buffer cylinder. Fill mechanism with heavy recoil oil, low pour point (U. S. A. Spec. 2-96). Replace filling plug. It is essential that mechanism be filled completely with recoil oil at all times.

■ 45. DRAINING FRONT BUFFER CYLINDER (fig. 8).—With gun elevated slightly above horizontal, remove drain plug (8) located at bottom of cylinder.

■ 46. FILLING REAR BUFFER CYLINDER (fig. 9).—Set gun at 0° elevation, remove pipe plug (10), and fill with heavy recoil oil, low pour point (U. S. A. Spec. 2-96) until oil is level with filling plug hole. Replace pipe plug.

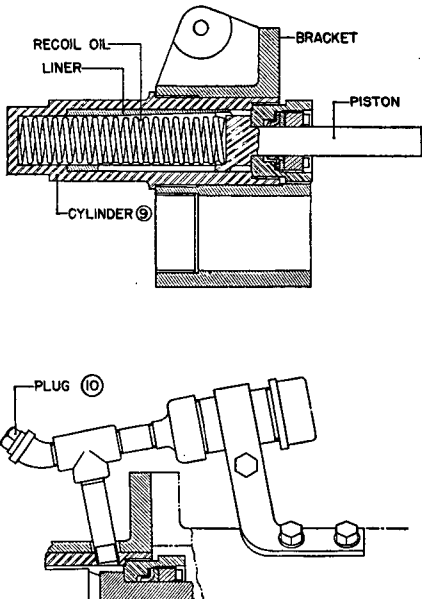


FIGURE 9.—Rear buffer (sectioned views).

CHAPTER 9

LUBRICATION

■ 47. GENERAL.—*a.* The various lubricants and cleaning and preserving materials issued by the Ordnance Department are described in *TM 9-850. No lubricants will be used other than those authorized nor will any lubricant be used in a manner other than as prescribed.

b. (1) The breech mechanism is not provided with oil holes, and many of the bearing surfaces may be oiled only after disassembly. See also paragraphs 25 and 26.

(2) The mount is provided with bayonet type fittings, with oil plugs, and with oil holes. Fittings and plugs are painted red and each oil hole is marked by a red ring. See also paragraphs 28 to 31, inclusive.

c. Care must be taken when cleaning oil and grease compartments to insure the complete removal of residue or sediment and to prevent the entrance of dirt or other foreign matter.

■ 48. LUBRICATION CHART.—The following chart shows the part or parts to be lubricated together with the method and lubricant to be used:

LUBRICATION CHART

Type oiler	Location	Lubricant	How applied	Remarks
	<i>Gun liners</i>			
Fitting.....	On left side of cradle (2 places).	Mineral lubricating grease, medium grade.	Grease gun.	One-fourth contents of gun twice daily.
Oil plugs.....	On top of cradle (2 places).	Light lubricating oil, class D.	Oiler...	Fill oil hole twice daily.

*See Appendix.

LUBRICATION CHART—Continued

Type oiler	Location	Lubricant	How applied	Remarks
<i>Breech mechanism</i>				
Fitting-----	On under side of breech (3 places).	Mineral lubricating grease, medium grade.	Grease gun.	One turn of gun once per day.
Oil cup-----	On inside surface of breechblock (2 places).	Light lubricating oil, class D.	Oiler---	Fill oil cups once per day.
Do-----	On cap over closing spring mechanism (1 place).	-----do-----	-----do-----	Do.
Do-----	Behind breech operating handle (1 place).	-----do-----	-----do-----	Fill oil hole once per week.
<i>Trunnions</i>				
Fitting-----	On cover over each trunnion bearing (1 place).	Mineral lubricating grease, soft grade.	Grease gun.	One turn of gun once per week.
<i>Loading mechanism</i>				
Oily wool----	Packed around fulcrum of kicker.	Light lubricating oil, class D.	Oiler---	Soak once per month.
Oil grooves--	In kicker roller (2 places).	-----do-----	-----do-----	Fill once per day.
Oil plug-----	On right cradle extension over kicker fork (1 place).	-----do-----	-----do-----	Fill oil hole once per day.
	Keyway of rammer.	-----do-----	-----do-----	Drops once per day.
Do-----	On right cradle extension over slides for loading mechanism.	-----do-----	-----do-----	Fill oil hole once per day.
	NOTE.—To be oiled with mechanism in released position.			
Do-----	On bracket over joint in rammer latch release (1 place).	-----do-----	-----do-----	Do.

LUBRICATION CHART—Continued

Type oiler	Location	Lubricant	How applied	Remarks
	<i>Loading mechanism—Continued</i>			
Oil plug-----	On bracket of cam that releases rammer latch (1 place).	Light lubricating oil, class D.	Oiler---	Fill oil hole once per day.
Oil plugs-----	On top of rammer retracting mechanism (3 places).	---do-----	---do---	Drops once per day.
	<i>Pedestal</i>			
Oil cup-----	Over bushing at bottom of pedestal (1 place).	---do-----	---do---	Fill oil cup once per day.
Oil cups-----	On working platform for oiling rollers (4 places).	---do-----	---do---	Do.
Clips-----	For keeping gun from tipping.	Lubricating graphite grease, medium.	Cover bearing surface.	Once per week.
	<i>Traversing mechanism</i>			
Oil plug-----	On side of gear case (1 place).	Light lubricating oil, class D.	Oiler---	Fill once per week.
Oil plugs-----	On ends of shafts (4 places).	---do-----	---do---	Fill oil hole once per day.
	<i>Elevating mechanism</i>			
Fittings-----	One behind each handwheel (2 places).	Mineral lubricating grease, soft grade.	Grease gun.	One turn of gun once per week.
Oil plugs-----	On elevating bracket; one on gear case and one on each side of pinion.	Light lubricating oil, class D.	---do---	Do.

LUBRICATION CHART—Continued

Type oiler	Location	Lubricant	How applied	Remarks
	<i>Azimuth receiver drive</i>			
Fitting-----	On top of gear case (1 place).	Mineral lubricating grease, soft grade.	Grease gun.	One turn of gun once per week.
Do-----	Over bearings at bottom of shaft (1 place).	do-----	do-----	Do.
	<i>Elevating receiver drive</i>			
Fittings-----	One on each side of the pinion (2 places).	do-----	do-----	Do.
	<i>Air pump</i>			
Holes-----	On cap of inner cylinder (4 places).	Neat's-foot oil-----	Oiler---	Drops before using.
	<i>Miscellaneous</i>			
Surfaces-----	All exposed moving parts with no facilities for oiling.	Light lubricating oil, class D.	do-----	Drops once per day.
Do-----	All exposed gear and rack teeth and all exposed guide rods.	Lubricating graphite grease, medium.	Brush--	Coat once per week.

DRILL TABLE

Service of the piece, 105-mm antiaircraft gun

Details	DETAILS, POSTS	(a) EXAMINE GUN (b) REPORT	TARGET	COMMENCE FIRING (LOAD)	(a) SUSPEND FIRING (b) CEASE FIRING
Gunner.....	Procures wiper of cotton waste and can of oil; places wiper and oil in convenient place, and takes post to right rear of piece opposite to and facing end of loading tray.	(a) Assisted by Nos. 1 and 3, examines, cleans, and oils breechblock, breech mechanism, and rammer mechanism; tests firing and rammer mechanisms; examines chamber and bore; and, if necessary, calls upon Nos. 2 to 8, inclusive, for assistance in sponging and cleaning chamber and bore. Assisted by No. 1, inspects oil level in recoil cylinder and front and rear buffer cylinders, under direction of gun commander, and, when necessary, fills those cylinders with recoil oil. When so directed by gun commander, obtains hand air pump and replenishes air pressure in rammer cylinder, being assisted by No. 1. (b) Reports to gun commander, "Breech in order," or reports any defects he is unable to remedy without delay.	Supervises opening of breech and retraction of rammer, holding up end of rammer retracting cam while No. 1 retracts rammer. When rounds are being placed in loading tray broadside (at high angles of elevation), as soon as rammer has been retracted, pulls back on rammer head release lever, dropping rammer head to its loading position. When ejected cartridge cases are to be stopped in loading tray, he turns rammer tripping cam to its "engaged" position so that, during last portion of movement of rammer body to rear, rammer head will be forced down into its lower position.	When rounds are being placed in loading tray from rear (at low or medium angles of elevation), drops rammer head after round has been placed in loading tray in front of rammer head. At the command RAM, given by No. 3 (4, 5, 6, 7, or 8) after round has slipped back or been pushed back into contact with rammer head (at any angle of elevation), he trips rammer by pulling back on rammer latch release lever and immediately grasps lanyard in his right hand. As soon as breech has closed, he fires piece by a pull on lanyard. In case of misfire he calls, "Misfire," to gun commander and keeps all cannoneers clear of breech.	(a) If an unfired round is in gun, directs No. 1 to retract and drop rammer head just to rear of breech and then drop breechblock with hand lever. After extractors have thrown round back against rammer head, directs No. 1 to continue retracting rammer until it is latched back in loading position, and directs a member of loading detail to remove round from loading tray. (b) Same as SUSPEND FIRING.
Fuze range setter.....	Takes post seated on left of gun facing fuze setter.	(a) Examines, cleans, and oils (when necessary) fuze setter, fuze range indicator, and connections thereto, assisted by No. 2. Makes sure that swing bolt nuts are both tight. Releases setting handwheel by means of knob at rear of fuze setter, pulling knob directly to rear. As soon as No. 2 has operated unloaded fuze setter through one or more cycles, tests operation of fuze setter by setting and checking fuze at several values, assisted by No. 2 and No. 4. (b) Reports to gun commander, "Fuze setter in order," or reports defects he is unable to remedy without delay.	Turns adjusting handwheel so as to match mechanical pointer with electrical pointer of fuze range indicator, and thereafter keeps pointers matched.	Continues to keep pointers matched.....	(a) Continues to keep pointers matched. (b) Sets mechanical pointer to fuze setting "15" (for mechanical fuze, M2) and directs a member of loading detail to remove round in setter. Supervises setting to 15 of any other rounds necessary, checking each fuze as it is removed from setter. Remains at post.
Azimuth setter.....	Takes post seated on left side of gun facing azimuth indicator.	(a) Examines traversing mechanism and assures himself that power is turned on in azimuth indicator. Assists gun commander in checking adjustment of mechanical pointer and synchronization of electrical pointer. (b) Reports to gun commander, "Traversing in order," or reports any defects he is unable to remedy without delay.	Traverses gun so as to match mechanical pointers with electrical pointers of azimuth indicator, and thereafter keeps those pointers matched.	Continues to keep pointers matched.....	(a) Continues to keep pointers matched. (b) Stops matching pointers but remains at post.
Elevation setter.....	Takes post seated on right side of gun facing elevation indicator.	(a) Examines elevating mechanism and assures himself that power is turned on in elevation indicator. Assists gun commander in checking adjustment of mechanical pointer and synchronization of electrical pointer. (b) Reports to gun commander, "Elevating in order," or reports any defects he is unable to remedy without delay.	Elevates or depresses gun so as to match mechanical pointers with electrical pointers of elevation indicator, and thereafter keeps those pointers matched.	Continues to keep pointers matched.....	(a) Continues to keep pointers matched. (b) Stops matching pointers but remains at post.
No. 1 (breech operator)...	Removes and folds up gun cover, assisted by No. 6, and deposits it at designated place. Takes post on right of gun standing on breech-operating platform facing breech-operating handle.	(a) Assists gunner in examining, cleaning, and oiling breech mechanism, rammer, firing mechanism, chamber, and bore of gun. Assists gunner in inspecting oil level in recoil cylinder and front and rear buffer cylinders, and, when necessary, assists in filling those cylinders with recoil oil. When so directed by gun commander, assists gunner in obtaining hand air pump and replenishing air pressure in rammer cylinder. Sets rammer release tripping cam as directed by gun commander. (b) No duties.	Opens breech by bearing down on operating handle until breechblock is locked open, and immediately raises handle to its vertical position. By means of rammer retracting wheel, retracts rammer to its loading position as directed by gunner.	No duties, unless hand operation of breech is ordered, in which case, opens breech after each round.	(a) If unfired round is in gun, retracts rammer so that head will drop directly behind breech, drops rammer head, opens breech, and eases unfired round back into loading tray by retracting rammer head until rammer is latched back in loading position, as directed by gunner. (b) Same as SUSPEND FIRING.
No. 2 (fuze setter operator).	Removes muzzle cover and puts it in designated place. Takes post standing to right of fuze range setter facing fuze setter.	(a) Assists fuze range setter in examining, cleaning, and oiling fuze setting mechanism. When setting handwheel has been released, operates unloaded fuze setter through one or more setting cycles (by turning handwheel clockwise) to see that handwheel stops and locks at end of fourth turn of each cycle. Assists fuze range setter in setting and checking fuze at several values. If necessary, assists gunner in sponging bore. (b) No duties.	Locks setting handwheel by turning it clockwise until it is stopped automatically.	With a round in the fuze setter, rotates setting handwheel quickly until it brings up against stop, turning handle in clockwise direction. On completion of fuze setting operation, calls "Cut." Continues to set fuzes as quickly as projectiles are inserted in fuze setter.	(a) Sets fuze if unset round is in fuze setter or if round is placed in fuze setter after receipt of command. (b) Remains at post prepared to set such fuzes back to 15 as may be necessary.
Nos. 3, 4, 5, 6, 7, and 8 (loading detail).	No. 3 procures chamber and bore sponge and wiper of cotton waste, disposes of sponges in designated place, and takes post at the ammunition rack facing breech of gun. No. 4, assisted by Nos. 5, 6, 7, and 8, uncovers ammunition on rack. No. 6 assists No. 1 in removing and disposing of gun cover. Nos. 4, 5, 6, 7, and 8 take posts at ammunition rack, in column behind No. 3.	(a) No. 3 assists gunner in examining, cleaning, and oiling breech mechanism, rammer, firing mechanism, chamber, and bore of gun. Sets breech operating cam plunger for automatic or hand operation of breech, as directed by gun commander. No. 4, assisted by Nos. 5, 6, 7, and 8, checks ammunition on rack. When called upon by gunner, all six men assist in sponging chamber and bore of gun. No. 4 assists fuze range setter in testing operation of fuze setter by setting and checking fuze at several values. (b) No. 4 reports to gun commander, "Ammunition handling in order," or reports such defects as he is unable to remedy without delay.	No. 3 takes round from ammunition rack, right hand grasping base of cartridge case, with rotating band of projectile resting in crook of left arm, and proceeds by most direct route to fuze setter. Rests projectile on edge of mouth of fuze setter and then inserts round into setter with right hand with one continuous motion and with sufficient force to complete seating. When round is locked in fuze setter, releases round immediately. Nos. 4, 5, 6, 7, and 8 each grasp round as prescribed for No. 3 and proceed to left of fuze setter, where they stand in readiness to deposit their rounds, in turn, in setter.	As soon as No. 2 has called "Cut," No. 3 grasps base of cartridge case with both hands and starts round to rear with quick pull without rotation. When firing is at high angles of elevation, catches rotating band of projectile in crook of his left arm, with right hand remaining under base end of case, steps toward gun, and deposits round, broadside, in loading tray with right hand just clearing rammer head. When firing is at low or medium angles of elevation, when loading tray is too high for broadside loading, catches rotating band of projectile in palm of left hand, with right hand remaining under base end of case, steps toward gun, inserts nose of round in rear of loading tray, and pushes round forward until base of case is in front of rammer head. In either method of loading, after rammer head has been dropped, adjusts round backward into contact with rammer head, steps away quickly, and commands: RAM. Returns to ammunition rack, obtains another round, and falls in behind No. 8 on left of fuze setter. Nos. 4, 5, 6, 7, and 8, in turn, perform operations just described for No. 3 as firing proceeds.	(a) If unfired round is in gun, as soon as it is ejected onto loading tray, it is removed and laid aside by that member of loading detail who loaded it. If there is no round in fuze setter, the next succeeding member of loading detail inserts one, and remaining members of loading detail stand ready to continue service of ammunition when firing is resumed. (b) If there is a round in fuze setter, it is removed and returned to ammunition rack by member of loading detail as soon as it has been set to 15. Other rounds which have been laid aside with their fuzes set are inserted in fuze setter by members of loading detail; when fuzes are set to 15, rounds are returned to ammunition rack.
Nos. 9 to 16, inclusive (ammunition squad).	No. 9 obtains pair of asbestos gloves and puts them in convenient place near breech of gun. Nos. 9 to 16, inclusive, are posted by chief of ammunition squad in such manner as to expedite supply of ammunition.	(a) Remove from boxes or crates and prepare necessary ammunition for contemplated practice or action. Fill ammunition racks at gun emplacement. (b) No duties.	No. 9 stands ready to remove empty cartridge cases from emplacement. The remaining members of ammunition squad stand ready to keep rack at gun emplacement filled with ammunition as it is used.	No. 9 catches (or takes from loading tray) empty cartridge cases as they are ejected from gun and removes them from emplacement. Remaining members of squad continue supply of ammunition to rack. Whenever practicable without interfering with gun squad, or during lulls in firing, collect and place at designated point all empty cases preparatory to decapping and cleaning for salvage.	(a) Collect all empty cases, fill ammunition racks, and return to their posts. (b) Same as SUSPEND FIRING.

APPENDIX

LIST OF REFERENCES

Ammunition, general.....	TM 9-1900 (now published as TR 1370-A).
Antiaircraft ammunition.....	TM 9-375 (now published as TR 1360-3A).
Artillery gun book.....	Ordnance Field Service Bulletin No. 4-1.
Care and maintenance of matériel.	TM 9-850 (now published as TR 1395-A).
Coast artillery ammunition.....	TM 4-205.
Coast artillery weapons and matériel.	TM 4-210.
Data receivers.....	FM 4-110; TM 9-375 (now published as supplement to SNL D-18).
Description, operation, and functioning of matériel.	TM 9-375 (now published as supplement to SNL D-18).
Drill ammunition.....	TM 9-375 (now published as TR 1370-D).
Field manuals.....	4-105, 4-110, 4-120, 4-150, and 4-155.
Fuze setter, M9.....	Notes, Rock Island Arsenal, Revised to December, 1939.
Nomenclature, parts and equipment.	SNL No. D-18.
Safety precautions in firing.....	AR 750-10; TM 4-235 (now published as TM 2160-35).
Sighting and fire-control equipment.	TM 9-375 (now published as TR 1310-50).

